

TITLE OF THE INVENTION

SEMICONDUCTOR DEVICE FORMED IN SEMICONDUCTOR LAYER ON
INSULATING FILM

CROSS-REFERENCE TO RELATED APPLICATIONS

5 This application is based upon and claims the
benefit of priority from the prior Japanese Patent
Application No. 2003-121630, filed April 25, 2003, the
entire contents of which are incorporated herein by
reference.

10 BACKGROUND OF THE INVENTION

1. Field of the Invention

 The present invention relates to a semiconductor
device formed in a semiconductor layer on an insulating
film, particularly relates to a static random access
15 memory formed in a semiconductor layer on an insulating
film.

2. Description of the Related Art

 A semiconductor memory typified by a static random
access memory (hereinafter referred to as SRAM) is
20 recently produced in the form of a large scale
integrated circuit more and more. In order to realize
the large scale SRAM, it is strongly desired that a
cell layout can reduce a cell area and suppress
difficulty of a manufacturing process.

25 Conventionally, various kinds of layouts of a six-
transistor type of SRAM cell which is constituted by
six transistors are disclosed (for example, see Jpn.

Pat. Appln. KOKAI Publication No. 10-178110). FIG. 1 shows an example of a layout different from the layout disclosed in Jpn. Pat. Appln. KOKAI Publication No. 10-178110. These two layouts shown in FIG. 1 and Jpn. Pat. Appln. KOKAI Publication No. 10-178110 are characterized in that, when a pattern in the cell is rotated 180 degrees about point C, the pattern is superimposed on the original pattern and adjacent cells become the line-symmetry pattern having a line of symmetry as a cell boundary line. These layouts have a relatively larger margin in a resist forming process, so that it is expected as the future layout of the miniaturized SRAM cell.

The layout shown in FIG. 1 has a butting diffusion where an N⁺ type of diffusion layer is adjacent to a P⁺ type of diffusion layer. When the butting diffusion is used, the area of the SRAM cell can be reduced compared with the layout disclosed in Jpn. Pat. Appln. KOKAI Publication No. 10-178110. The layout shown in FIG. 1 is one which is useful in connecting the N⁺ type of diffusion layer to the P⁺ type of diffusion layer by using a thin-film SOI substrate, which has a silicon layer (thickness of about 100 nm) formed on the insulating film, and by using silicide bonded to the diffusion layer without forming a well region. The SOI (Silicon On Insulator) substrate is a substrate having the structure in which the semiconductor layer such as

a silicon layer is formed on the insulating film.

In an SRAM cell 101 shown in FIG. 1, a shared contact SC commonly connected to a gate electrode GL and an active area AA is formed with a hole extending over the gate electrode GL and the active area AA. The area of the SRAM cell 101 can be reduced by using the shared contact SC. Reference symbol CVC indicates a contact supplied with power supply voltage V_{cc} , CVS indicates a contact supplied with reference electric potential V_{ss} , and CBL indicates a contact connected to a bit line, respectively.

However, there are some problems in the above-described cell layout shown in FIG. 1.

First, in a narrow space between the gate electrodes with a length of about $0.1\ \mu\text{m}$, which is indicated by D1 in FIG. 1, since it is very difficult to form a mask and there is a smaller margin of a process forming a resist pattern, deviation in size of the space between the gate electrodes is increased. Accordingly, it is very difficult to produce the large scale SRAM with good reproducibility.

Secondly, in a narrow space between the gate electrodes, which is indicated by D2 in FIG. 1, there is a problem that a resist residue is easily caused by a projection indicated by P, i.e. compared with the case of absence of the projection, and the margin of the process forming the resist pattern is small.

Thirdly, in the size in a major axis direction of the shared contact SC, variation is larger than that in a minor axis direction. This is because there is the variation in the mask forming process and the resist forming process. Consequently, there is the problem that the size in a longitudinal direction (short-side direction) of the SRAM cell 101 can not be reduced because of concerns about a short circuit to the adjacent gate electrode.

In the fourth, it is necessary in the layout shown in FIG. 1 to secure a distance of an extent of resolution limit of lithography as an isolation width, indicated by D3, between p-channel MOS transistors. A width in a lateral direction, indicated by D4, between the adjacent regions is required to secure the distance, considering misalignment of the resist mask in ion implantation of an N-type impurity and a P-type impurity. Accordingly, there is the problem that the size in a lateral direction (long side direction) of the SRAM cell 101 can not be reduced.

BRIEF SUMMARY OF THE INVENTION

According to an aspect of the present invention, there is provided a semiconductor device comprising: a first conductive type of first MOS transistor which is formed in a first active area and in which a gate is configured from a first gate electrode, the first gate electrode having an end portion projecting from the

first active area; a second active area arranged
adjacent to the first active area; a second conductive
type of second MOS transistor which is formed in the
second active area and in which a gate is configured
5 from the first gate electrode; a second conductive type
of third MOS transistor which is formed in the second
active area and in which a gate is configured from a
second gate electrode; a third active area formed apart
10 from the first active area; a first conductive type of
fourth MOS transistor which is formed in the third
active area and in which a gate is configured from a
third gate electrode, the third gate electrode having
an end portion projecting from the third active area; a
15 fourth active area arranged adjacent to the third
active area; a second conductive type of fifth MOS
transistor which is formed in the fourth active area
and in which a gate is configured from the third gate
electrode; and a second conductive type of sixth MOS
20 transistor which is formed in the fourth active area
and in which a gate is configured from a fourth gate
electrode, wherein the end portion of the first gate
electrode projecting from the first active area is
obliquely arranged relative to a gate width direction
25 of the first MOS transistor, and the end portion of the
third gate electrode projecting from the third active
area is obliquely arranged relative to a gate width
direction of the fourth MOS transistor.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

FIG. 1 is a plan view showing a configuration of a semiconductor device having a conventional SRAM cell;

FIG. 2 is a plan view showing a configuration of a semiconductor device having a six-transistor type of SRAM cell formed on an SOI substrate according to a first embodiment of the invention;

FIG. 3 is a plan view showing a configuration of a semiconductor device having a six-transistor type of SRAM cell formed on an SOI substrate according to a second embodiment of the invention;

FIG. 4 is a plan view showing a configuration of a semiconductor device having a six-transistor type of SRAM cell formed on an SOI substrate according to a third embodiment of the invention;

FIG. 5 is a sectional view taken along line A-B of the semiconductor device shown in FIG. 4;

FIG. 6 is a sectional view taken along line E-F of the semiconductor device shown in FIG. 4;

FIG. 7 shows a layout of a first interconnection and a pattern of a contact portion in the semiconductor device shown in FIG. 4;

FIG. 8 shows a layout of a second interconnection and the pattern of the contact portion in the semiconductor device shown in FIG. 4; and

FIG. 9 shows a layout of a third interconnection and the pattern of the contact portion in the

semiconductor device shown in FIG. 4.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the accompanying drawings, preferred embodiments of the invention will be described below.

5 In the following description, common areas and regions are indicated with common reference numerals and signs.
[First embodiment]

A semiconductor device according to a first embodiment of the invention will be described at first.

10 FIG. 2 is a plan view showing a configuration of a semiconductor device having a six-transistor type of SRAM cell formed on an SOI substrate according to the first embodiment of the invention.

A load transistor LO1, a transfer transistor TR1, and a driver transistor DR1 are arranged in the SRAM cell 11 of the silicon semiconductor layer on the insulating film. Further, in the SRAM cell 11, a load transistor LO2, a transfer transistor TR2, and a driver transistor DR2 are arranged at point symmetry on the basis of point C relative to the load transistor LO1, the transfer transistor TR1, and the driver transistor DR1.

A PMOS region where the p-channel MOS transistor is formed is arranged in the SRAM cell 11. Two NMOS region where the n-channel MOS transistor is formed are also arranged so as to sandwich the PMOS region. Active areas (device areas) PD1 and PD2, which are

separated by an isolation area 12, are formed in the PMOS region. The active areas PD1 and PD2 include a semiconductor area such as a silicon layer. The load transistor LO1 which is the p-channel MOS transistor is formed in the active area PD1, and the load transistor LO2 which is the p-channel MOS transistor is formed in the active area PD2.

An active area (device area) ND1, which is separated by the isolation area 12, is formed in an NMOS region on the right side of the PMOS region. The active area ND1 includes a semiconductor area such as a silicon layer. The transfer transistor TR1 and the driver transistor DR1 which are the n-channel MOS transistor are formed in the active area ND1.

An active area (device area) ND2, which is separated by the isolation area 12, is formed in an NMOS region on the left side of the PMOS region. The active area ND2 includes a semiconductor area such as a silicon layer. The transfer transistor TR2 and the driver transistor DR2 which are the n-channel MOS transistor are formed in the active area ND2.

On the right side of the SRAM cell 11 in FIG. 2, the SRAM cell 11 is formed at line symmetry on the basis of a boundary line 11A of the SRAM cell 11. That is, a driver transistor DR3 is arranged to be adjacent to the right side of the driver transistor DR1 and a transfer transistor TR3 is arranged to be adjacent to

the right side of the transfer transistor TR1.

Similarly, on the left side of the SRAM cell 11 in FIG. 2, the SRAM cell 11 is formed at line symmetry on the basis of a boundary line 11B of the SRAM cell 11.

5 That is, a driver transistor DR4 is arranged to be adjacent to the left side of the driver transistor DR2 and a transfer transistor TR4 is arranged to be adjacent to the left side of the transfer transistor TR2.

10 On the upper side of the SRAM cell 11 in FIG. 2, the SRAM cell 11 is formed at line symmetry on the basis of a boundary line 11C of the SRAM cell 11. Further, on the lower side of the SRAM cell 11 in FIG. 2, the SRAM cell 11 is formed at line symmetry on
15 the basis of a boundary line 11D of the SRAM cell 11.

A contact C1 supplied with the power supply voltage Vcc is formed on one side of the active area PD1 where the load transistor LO1 is formed. A shared contact SC1 commonly connected to the other side of the
20 active area PD1 and a gate fringe F2 of the load transistor LO2 is formed on the other side of the active area PD1 and on the gate fringe F2. Similarly, a contact C2 supplied with the power supply voltage Vcc is formed on one side of the active area PD2 where the
25 load transistor LO2 is formed. A shared contact SC2 commonly connected to the other side of the active area PD2 and a gate fringe F1 of the load transistor LO1 is

formed on the other side of the active area PD2 and on the gate fringe F1.

A contact C3 connected to a bit line is formed on one side of the active area ND1 where the transfer transistor TR1 is formed. Similarly, a contact C4 connected to the bit line is formed on one side of the active area ND2 where the transfer transistor TR2 is formed.

A contact C5 supplied with the reference electric potential Vss is formed on the other side of the active area ND1 where the driver transistor DR1 is formed. Similarly, a contact C6 supplied with the reference electric potential Vss is formed on the other side of the active area ND2 where the driver transistor DR2 is formed.

The gate fringe F1 of the load transistor L01 is obliquely formed relative to the direction of gate width on the channel (channel width direction) in the load transistor L01. In other words, the gate fringe F1 of the load transistor L01 is obliquely formed relative to boundary lines 11C and 11D in the long side direction of the SRAM cell 11. The gate fringe F2 of the load transistor L02 is also obliquely formed relative to the gate width direction on the channel in the load transistor L02. In other words, the gate fringe F2 of the load transistor L02 is obliquely formed relative to the boundary lines 11C and 11D.

For example, the gate width direction and the gate fringe F1 of the load transistor LO1 are arranged at an angle of about 20 degrees from each other. Similarly, the gate width direction and the gate fringe F2 of the load transistor LO2 are arranged at the angle of about 20 degrees from each other. Here, the gate fringe means an end portion of the gate electrode which projects from the active area and is present on the isolation area 12.

In the SRAM cell 11 having the layout in which the gate fringe of the load transistor is obliquely formed relative to the direction of gate width on the channel (channel width direction), compared with the conventional example shown in FIG. 1, the distance D1 between the gate fringe F2 of the load transistor LO2 and the gate fringe F3 of the transfer transistor TR1 can be lengthened. This allows the distance D1 between the gate fringes to be lengthened without increasing the size of the SRAM cell 11, so that the margin can be secured in the mask forming process and the resist forming process.

When the angle between the direction of the gate fringe F1 and the gate width direction of the load transistor LO1 is too large, since the distance between the gate fringe F1 and the gate electrode of the other load transistor LO2 in the SRAM cell 11 becomes small, the margin is reduced in the resist forming process.

Therefore, it is desirable that the angle between the direction of the gate fringe and the gate width direction of the load transistor is formed to be up to about 20 degrees.

5 The gate fringe F3 of the transfer transistor TR3 is obliquely formed relative to the direction of gate width on the channel (channel width direction) in the transfer transistor TR1. In other words, the gate fringe F3 of the transfer transistor TR1 is obliquely
10 formed relative to the boundary lines 11C and 11D in the long side direction of the SRAM cell 11. The gate fringe F4 of the transfer transistor TR2 is also obliquely formed relative to the gate width direction on the channel in the transfer transistor TR2. In
15 other words, the gate fringe F4 of the transfer transistor TR2 is obliquely formed relative to the boundary lines 11C and 11D.

 For example, the gate width direction and the gate fringe F3 of the transfer transistor TR1 are arranged
20 to be at the angle of about 20 degrees. Similarly, the gate width direction and the gate fringe F4 of the transfer transistor TR2 are arranged to be at the angle of about 20 degrees.

 In the SRAM cell 11 having the layout in which the
25 gate fringe of the transfer transistor is obliquely formed relative to the direction of gate width on the channel (channel width direction), compared with the

conventional example shown in FIG. 1, the distance D1 between the gate fringe F3 of the transfer transistor TR1 and the gate fringe F2 of the load transistor LO2 can be lengthened. This allows the distance D1 between the gate fringes to be lengthened without increasing the size of the SRAM cell 11, so that the margin can be secured in the mask forming process and the resist forming process.

Further, the distance between the gate fringe F3 of the transfer transistor TR1 and the shared contact SC1 can be lengthened, so that the short circuit between the gate fringe F3 and the shared contact SC1 can be decreased and defect probability can be decreased.

When the angle between the direction of the gate fringe F3 and the gate width direction of the transfer transistor TR1 is too large, the distance between the gate fringe F3 and the contact C3 connected to the bit line becomes small. Similarly, when the angle between the direction of the gate fringe F4 and the gate width direction of the transfer transistor TR2 is too large, the distance between the gate fringe F4 and the contact C4 connected to the bit line becomes small. Therefore, it is desirable that the angle between the gate fringe and the gate width direction of the transfer transistor is formed to be up to about 20 degrees.

In the conventional layout shown in FIG. 1,

the gate electrode on the channel of the driver transistor in a certain SRAM cell and the gate electrode on the channel of the driver transistor of the adjacent SRAM cell are arranged on the same line parallel to the long side direction of the SRAM cell, and the gate fringes of the driver transistors are opposed to each other with the distance D2 on the same line.

On the other hand, in the first embodiment, gate fringes F5 and F6 of the driver transistors DR1 and DR2 are obliquely formed relative to the boundary lines 11C and 11D in the long side direction of the SRAM cell. In other words, the gate fringe F5 of the driver transistor DR1 is obliquely formed relative to the direction of gate width on the channel (channel width direction) in the driver transistor DR1, and the gate fringe F6 of the driver transistor DR2 is obliquely formed relative to the direction of gate width on the channel (channel width direction) in the driver transistor DR2.

For example, the gate width direction and the gate fringe F5 of the driver transistor DR1 are arranged to be at the angle of about 20 degrees. Similarly, the gate width direction and the gate fringe F6 of the driver transistor DR2 are arranged to be at the angle of about 20 degrees. The fringe F5 is bent (toward the side) opposite to the side in which the projection P of

the gate electrode of the transfer transistor TR1 is formed, and the fringe F6 is bent (toward the side) opposite to the side in which the projection P of the gate electrode of the transfer transistor TR2 is formed.

In the SRAM cell 11 having the layout in which the gate fringe of the driver transistor is obliquely formed relative to the direction of gate width on the channel (channel width direction), compared with the conventional example shown in FIG. 1, the distance D2 between the gate fringe F5 of the driver transistor DR1 and the gate fringe of the driver transistor DR3 of the adjacent SRAM cell can be lengthened. Similarly, the distance between the gate fringe F6 of the driver transistor DR2 and the gate fringe of the driver transistor DR4 of the adjacent SRAM cell can be lengthened. This allows the distance D2 between the gate fringes to be lengthened without increasing the size of the SRAM cell 11, so that the margin can be secured in the mask forming process and the resist forming process. Further, the resist residue caused by approach of the gate fringe F5 or F6 to the projection P can be prevented.

When the angle between the gate fringe F5 and the gate width direction of the driver transistor DR1 is too large, the distance between the gate fringe F5 and the contact C5 supplied with the reference electric

potential Vss becomes small. Similarly, when the angle between the gate fringe F6 and the gate width direction of the driver transistor DR2 is too large, the distance between the gate fringe F6 and the contact C6 supplied with the reference electric potential Vss becomes small. Therefore, it is desirable that the angle between the gate fringe and the gate width direction of the driver transistor is formed to be up to about 20 degrees.

As described above, in the first embodiment, the distance between the gate fringes can be lengthened in such a manner that the gate fringe of the above-described transistor is obliquely formed relative to the gate width direction (channel width direction), in other words, the gate fringe of the above-described transistor is obliquely formed relative to an extended direction of the gate electrode arranged on the active area. Accordingly, the length in the long side direction of the SRAM cell can be reduced while the margin is secured in the lithography process, so that the size in the long side of the SRAM cell can be reduced.

Though the angle can not be defined in the strict sense of the word, when the gate fringe is not formed straight but is formed with curvature effect of the first embodiment can be relished. Though FIG. 2 shows the example in which all the gate fringes of the load

transistor, the transfer transistor, and the driver transistor are obliquely formed, only the gate fringe of at least any one of these transistors may be obliquely formed.

5 [Second embodiment]

A semiconductor device of a second embodiment of the invention will be described below. In addition to the configuration of the above-described first embodiment, the shared contact is obliquely arranged in
10 the second embodiment. The same areas and regions as those in the configuration of the first embodiment are indicated with the same reference numerals and signs and those descriptions are omitted. Only the areas and regions different from the first embodiment are
15 described.

FIG. 3 is a plan view showing a configuration of a semiconductor device having a six-transistor type of SRAM cell formed on an SOI substrate according to the second embodiment.

20 In the first embodiment, the major axis direction of the shared contact SC1 (or SC2) and the gate width direction (or the long side direction of the boundary line of the SRAM cell) of the load transistor L02 (or load transistor L01) are arranged at the angle of
25 90 degrees from each other.

In the second embodiment, as shown in FIG. 3, the major axis of the shared contact SC1 is obliquely

arranged relative to the gate width direction of the load transistor LO2 (or the long side direction of the boundary line of the SRAM cell). Similarly, the major axis of the shared contact SC2 is obliquely arranged
5 relative to the gate width direction of the load transistor LO1.

For example, the major axis direction of the shared contact SC1 and the gate width direction of the load transistor LO2 are arranged to be at the angle of
10 about 20 to 30 degrees. Similarly, the major axis direction of the shared contact SC2 and the gate width direction of the load transistor LO1 are arranged to be at the angle of about 20 to 30 degrees.

In this manner, in the SRAM cell 11 having the
15 layout described above, even if the size of the major axis of the shared contact is deviated, the deviation of the distance between the shared contact and the gate electrode can be reduced. Therefore, the size in the short side direction of the SRAM cell can be reduced.

20 As described above, in the second embodiment, the major axis direction of the shared contact is obliquely arranged relative to the gate width direction (or the long side direction of the boundary line of the SRAM cell) while the gate fringe of the transistor is
25 obliquely formed relative to the gate width direction (channel width direction), so that the distance between the gate fringes can be lengthened and the deviation of

the distance between the shared contact and the gate electrode can be reduced. Consequently, while the margin can be secured in the lithography process, the sizes of the long side and short side in the SRAM cell can be reduced, and the area of the SRAM cell can be also reduced.

[Third embodiment]

A semiconductor device of a third embodiment of the invention will be described below. In the conventional layout shown in FIG. 1, the direction D3

of the minimum isolation width between the adjacent load transistors is parallel to the boundary line of the long side direction of the SRAM cell.

In the third embodiment, the longitudinal direction of the diffusion layer on a node side of the load transistor and the boundary lines 11C and 11D in the long side direction of the SRAM cell 11 are obliquely arranged. The diffusion layer on the node side of the load transistor means the diffusion layer to which the contact C1 supplied with the power supply voltage Vcc is not connected. That is, the diffusion layer on the node side means a source/drain diffusion layer which is arranged on the opposite side of a source/drain diffusion layer connected to the contact C1 supplied with the power supply voltage Vcc. Further, the gate width direction of the transistor, the major axis directions of the shared contacts SC1

and SC2 are obliquely arranged relative to the boundary lines 11C and 11D in the long side direction of the SRAM cell 11. The same areas and regions as those in the configuration of the first embodiment are indicated with the same reference numerals and signs and those descriptions are omitted. Only the areas and regions of the configuration different from the first embodiment are described.

FIG. 4 is a plan view showing a configuration of a semiconductor device having a six-transistor type of SRAM cell formed on an SOI substrate according to the third embodiment.

As shown in FIG. 4, a diffusion layer LON1 on the node side of the load transistor LO1 is obliquely arranged relative to the boundary lines 11C and 11D in the long side of the SRAM cell 11. The gate width direction of the load transistor LO1 is obliquely arranged relative to the boundary lines 11C and 11D in the long side of the SRAM cell 11.

Similarly, a diffusion layer LON2 on the node side of the load transistor LO2 is obliquely arranged relative to the boundary lines 11C and 11D in the long side of the SRAM cell 11. The gate width direction of the load transistor LO2 is obliquely arranged relative to the boundary lines 11C and 11D in the long side of the SRAM cell 11.

For example, the diffusion layer LON1 on the node

side of the load transistor LO1 and the long side direction of the SRAM cell 11 are arranged at the angle of about 20 to 30 degrees from each other. Similarly, the diffusion layer LON2 on the node side of the load transistor LO2 and the long side direction of the SRAM cell 11 are arranged at the angle of about 20 to 30 degrees from each other.

Accordingly, the direction D3 of the minimum isolation width between the adjacent load transistors is arranged at the angle of 60 to 70 degrees relative to the boundary lines 11C and 11D in the long side direction of the SRAM cell 11.

In the SRAM cell 11 having the layout described above, the size in the long side direction of the SRAM cell 11 can be reduced to about 76% of the conventional example shown in FIG. 1. Since the same size as that of the conventional example can be secured in the short side direction of the SRAM cell 11, the cell area can be reduced to about 76% of the conventional example.

In the embodiment, the gate electrode of the transfer transistor TR1 (or TR2) does not have the projection P in the conventional example, and the gate electrode is formed with the pattern having the uniform width. It is desirable that the gate electrode of the transfer transistor TR1 (or TR2) is arranged to be across the center of a contact C7 (or C8). At this point, the width of the gate electrode in a contact

portion between the gate electrode and the contact C7
(or C8) on the gate electrode of the transfer
transistor TR1 (or TR2) is smaller than a diameter of
the contact C7 (or C8). This arrangement allows the
margin in the lithography process to be secured between
the gate electrodes shown by the distance D2 while the
increase in size in the short side direction of the
SRAM cell 11 is suppressed.

The gate width direction on the channel of the
driver transistor DR1 and the boundary lines 11C and
11D in the long side direction of the SRAM cell 11 are
arranged at the angle of 35 to 45 degrees from each
other. According to the arrangement, compared with the
conventional example shown in FIG. 1, the channel width
of the driver transistor DR1 is increased without
increasing the cell size, so that static noise margin
can be improved.

Since the distance between the adjacent shared
contacts SC1 and SC2 can be secured at the same extent
as the major axis, the resist forming process or the
formation of the electrode can be stably performed.

A sectional structure of the semiconductor device
of the third embodiment will be described below.
FIG. 5 is a sectional view taken along line A-B of the
semiconductor device shown in FIG. 4.

As shown in FIG. 5, the insulating film, e.g.
an oxide film 22 is formed on a semiconductor

substrate 21. Silicon layers 23A and 23B are formed as the active area in the oxide film 22. A gate insulating film 24 is formed on the silicon layer 23A, and a gate electrode 25 and a silicide layer 26 are
5 formed on the gate insulating film 24. A sidewall film 27 on the gate side such as the oxide film is formed on side surfaces of the gate electrode 25 and the silicide layer 26.

A silicide layer 28 is formed on the silicon
10 layer 23B. A tungsten film 29 is formed as the shared contact SC1 for connecting the silicide layers 26 and 28 on the silicide layers 26 and 28. An interlayer insulating film 30 is formed on the above-described structure, and a second interconnection 31 and a third
15 interconnection 32 are formed in the interlayer insulating film 30.

FIG. 6 is a sectional view taken along line E-F of the semiconductor device shown in FIG. 4.

As shown in FIG. 6, the insulating film, e.g.
20 the oxide film 22 is formed on the semiconductor substrate 21. The gate electrode 25 and the silicide layer 26 are formed on the oxide film 22. The sidewall film 27 on the gate side such as the oxide film is formed on side surfaces of the gate electrode 25 and
25 the silicide layer 26.

The interlayer insulating film 30 is formed on the above-described structure. The tungsten film 29 is

formed on the silicide layer 26 in the interlayer
insulating film 30, and it is formed as the contact C7
for connecting the silicide layer 26 and a first
interconnection 33. The first interconnection 33 is
5 formed on the tungsten film 29, and the second
interconnection 31 is formed on the first
interconnection 33 through a contact 34 under the
second interconnection. Further, the third
interconnection 32 is formed above the second
10 interconnection 31.

FIG. 7 shows the first interconnection 33,
the contact under the first interconnection, and the
pattern of the shared contact in the SRAM cell shown in
FIG. 4. FIG. 8 shows the second interconnection 31
15 and the pattern of the contact under the second
interconnection, and FIG. 9 shows the third
interconnection 32 and the pattern of the contact under
the third interconnection. In FIGS. 7 to 9, the
pattern of the contact is indicated by a broken line.

20 As described above, in the third embodiment, the
diffusion layer on the node side of the load transistor
is obliquely arranged relative to the long side
direction of the SRAM cell, the gate electrode of the
transfer transistor does not have the projection P, and
25 the gate electrode is formed with the pattern having
the uniform width. The gate width direction on the
channel of the driver transistor and the long side

direction of the SRAM cell 11 are arranged at the angle of 35 to 45 degrees from each other. According to the arrangement, the distance between the gate electrodes can be secured and the area of the SRAM cell can be
5 reduced.

As described above, according to the embodiments of the invention, it is possible to provide the semiconductor device having the layout in which the area can be reduced and the margin of the lithography
10 can be secured.

Not only each of the above-described embodiments can be individually realized, but also combination of the embodiments can be realized. Each of the above-described embodiments includes the invention of various
15 kinds of steps, and the invention of various kinds of steps can be also extracted by the appropriate combination of the plurality of constitutions disclosed in each embodiment.

Additional advantages and modifications will
20 readily occur to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details and representative embodiments shown and described herein. Accordingly, various modifications may be made without departing from the
25 spirit or scope of the general inventive concept as defined by the appended claims and their equivalents.